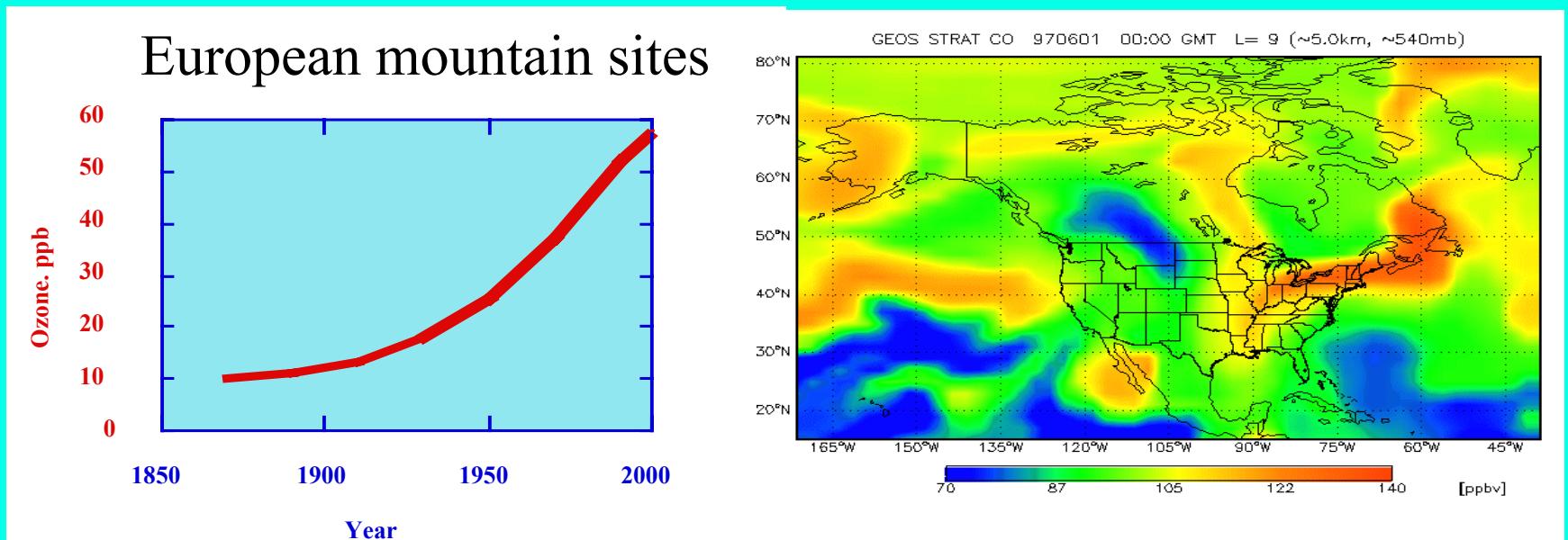
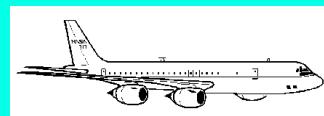


Air Pollution, Air chemistry & Climate Change

(O_3 -smog, 3rd most important GHG, atmospheric cleanser)



Marenco et al. 1994

ITCT:
Intercontinental Transport and Chemical Transformation

INTEX-NA: Intercontinental Chemical Transport Experiment- North America

(White paper <http://cloud1.arc.nasa.gov>)

- INTEX A: Summer (June/July) 2004
 - large biosphere emissions, active photochemistry
 - large optical depth/radiative forcing
 - maximum terrestrial carbon uptake
- INTEX B: Spring (April/May) 2006
 - maximum Asian inflow to NA
 - terrestrial biosphere net carbon source
 - Seasonal contrast

INTEX-NA/ICARTT CAMPAIGN - SUMMER 2004

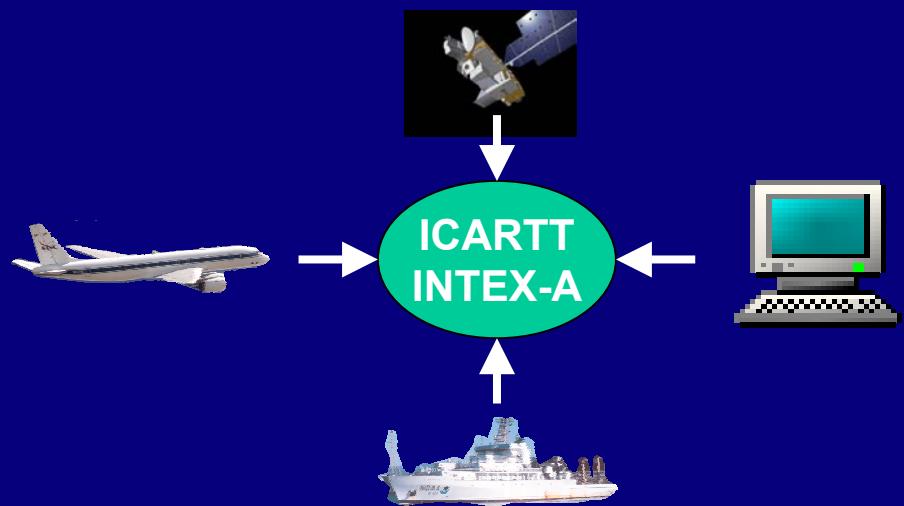
SCIENTIFIC OBJECTIVES

- *Characterize sources and transport of pollution in northeastern North America*
- *Quantify North American outflow of environmentally important gases/aerosols & relate to sources*
- *Characterize and understand Transatlantic Transport of North American pollution and its chemical evolution*
- *Characterize direct/indirect effects of aerosols over northeastern North America and western North Atlantic*
- *Use INTEX-A measurement strategy to validate Satellite data & relate to airborne and surface data*



INTEX-NA/ICARTT COORDINATION

- Forecast sharing
- Field data sharing
- Aircraft inter-comparisons
- Coordinated science flights
- Satellite validation
- Joint publications

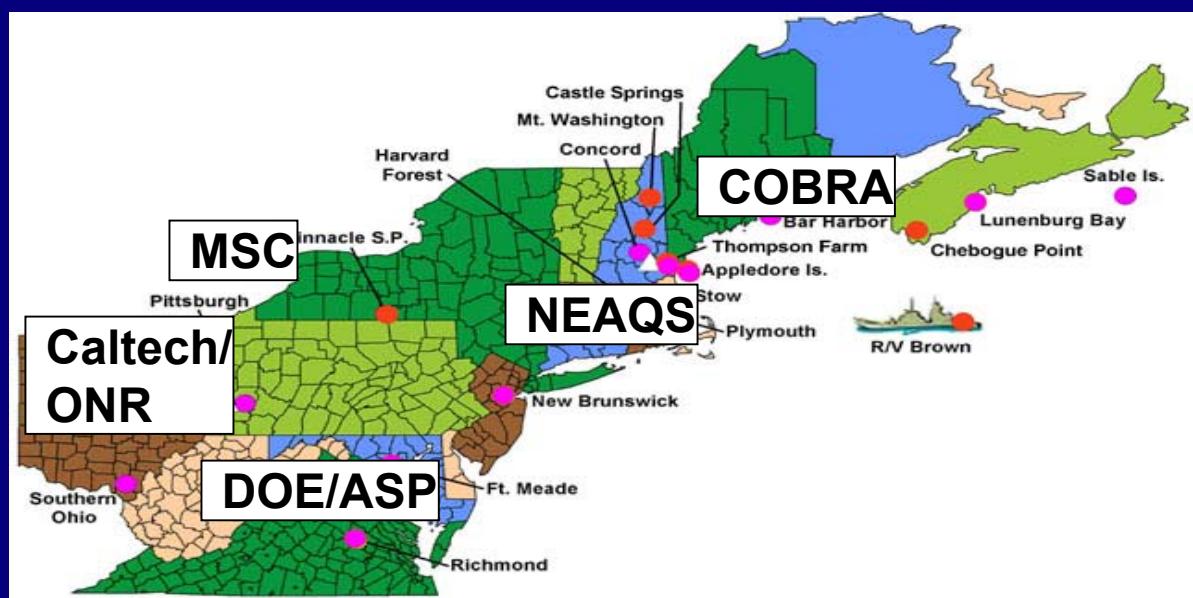
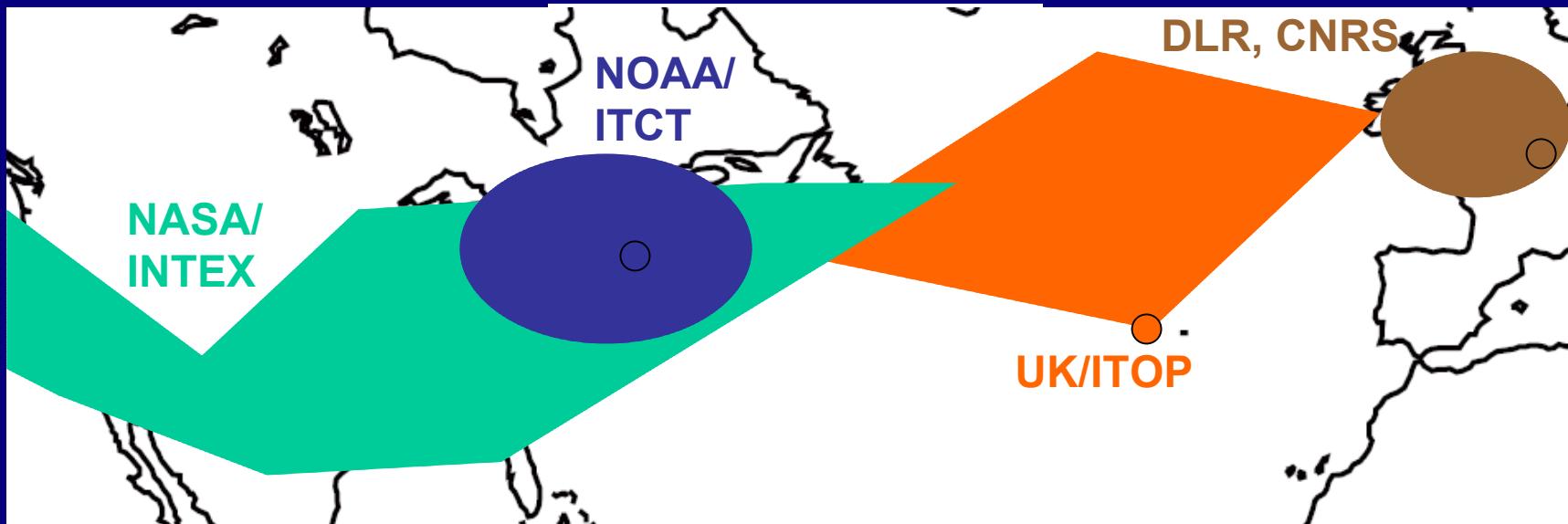


Main mobile platforms INTEX-A

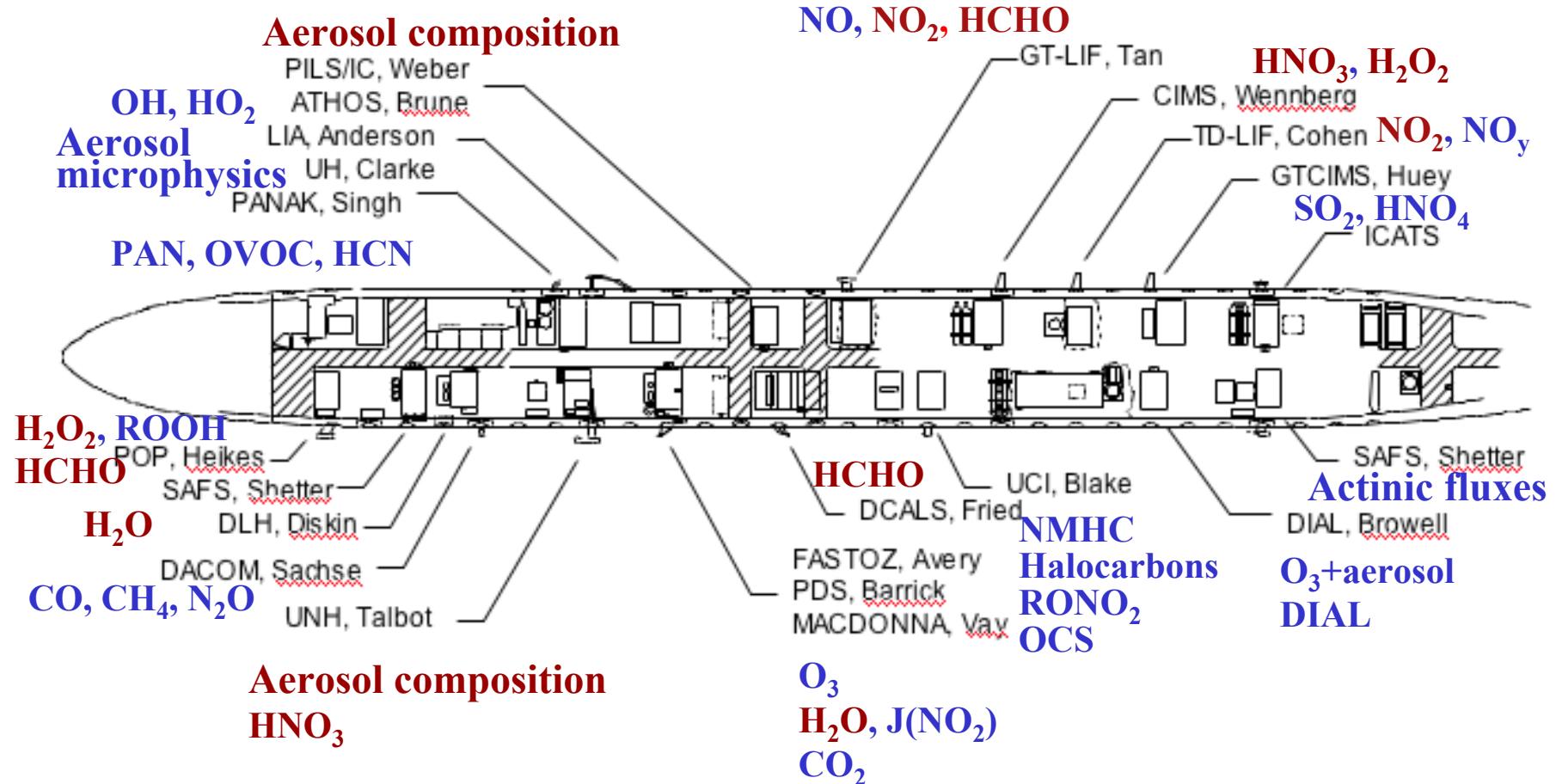
- NASA-DC8 (12 km, ED. CA, MA. IL, Pease NH) - **7/1 to 8/15**
- NASA-J31 (6 km, Pease NH)- **7/12 to 8/8**
- NOAA-P3 (7 km, Pease NH)- **7/1 to 8/15**
- NOAA-DC 3 (3 km, Pease NH)- **7/1 to 8/15**
- NOAA-Ship/Ron Brown (western Atlantic)- **7/6 to 8/13**
- DOE-G1 (7 km, Latrobe PA)- **7/1 to 8/15**
- NRL-Twin Otter (7 km, Cleveland OH)- **7/12 to 8/20**
- NSF-King Air (6 km, Bangor ME)- **7/1 to 8/31**
- UMD- Aztec (6 km, MD)- **5/5 to 9/30**
- ITOP/UK-BAe 146 (10 km, Azores)- **7/12 to 8/4**
- ITOP/DLR-Falcon (13 km, Creil-France)- **7/19 to 8/5**
- ITOP/Service d'Aéronomie- Falcon (13 km, Creil-France)- **7/19 to 8/5**
- Canada- Convair (7 km, Cleveland OH)- **7/12 to 8/20**
- US/EU Satellites (Terra/Aqua/Aura/Envisat)
- US/Proteus-UAV
- Balloons

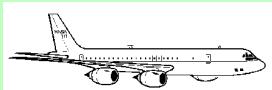


ICARTT TEAMS

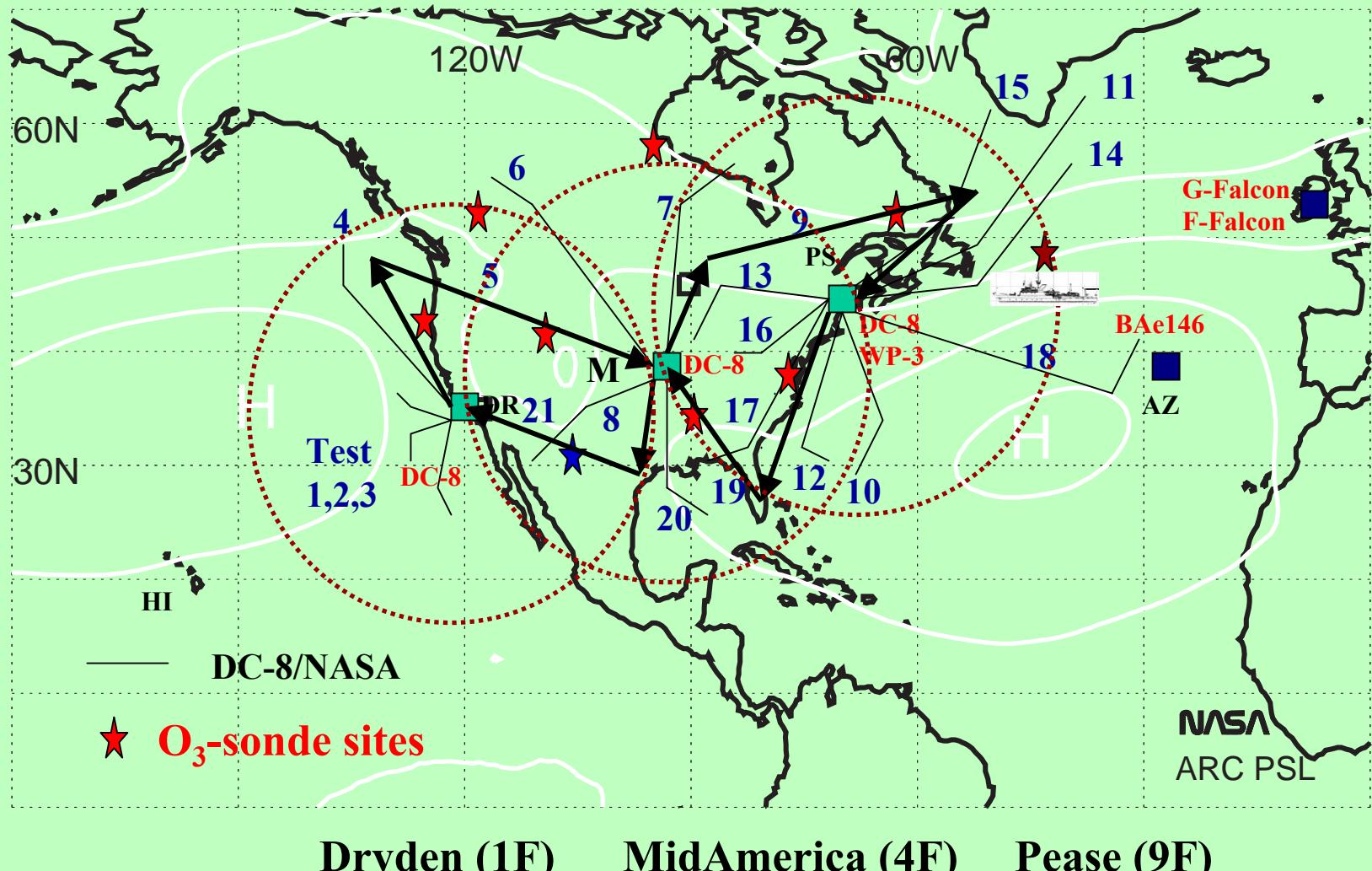


DC-8 Payload





INTEX-A strawman flight tracks



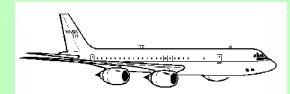
INTEX-A Measurement Strategy

(170 DC-8 flight hours)

- Inter-comparison flights among multiple platforms
- Large-scale characterization of the troposphere across North America including sources
- Characterization of continental boundary layer chemistry and venting
- Large-scale continental outflow characterization
- Chemical aging over North Atlantic (ITCT)
- Convective venting to the upper Trop
- Satellite validation flights



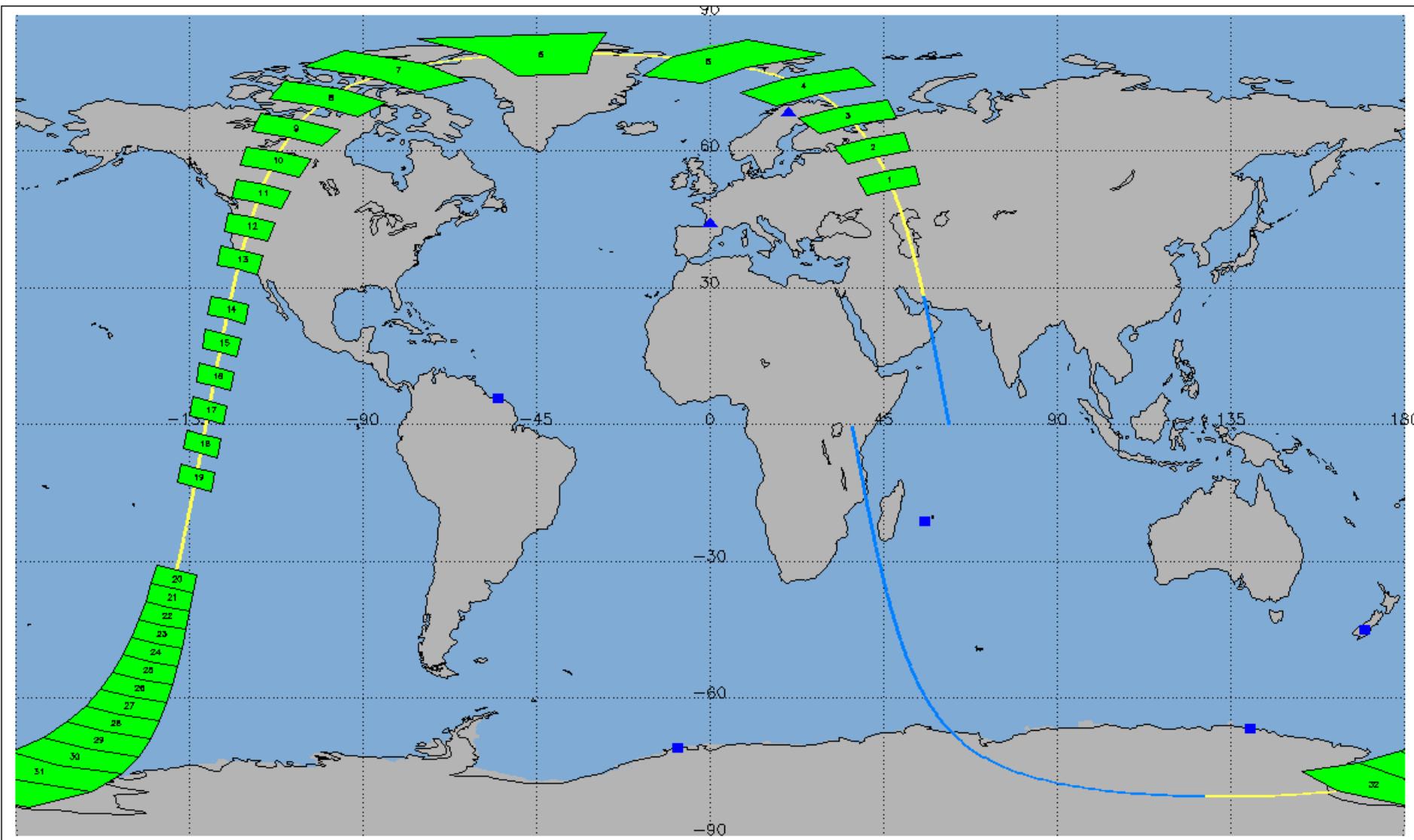
INTEX-NA & Satellite Observations



- **Satellites of primary focus:** Terra, Aqua, Envisat
 - **Instruments of primary focus:** MOPITT, AIRS, MISR, MODIS, SCHIA
 - **Species of primary focus :** O₃, CO, HCHO, NO₂, H₂O, AOD, CO₂ (?)
-
- **Satellite Validation**
 - **Integrating Sat/airborne observations with models**
 - **Linking Sat observation & surface data**

SCIAMACHY Nadir Sampling for 2 July, 17:52-19:30 UTC

SCIAMACHY Swath Geolocation Display for Nadir in Orbit 12234



Orig-Filename = SIM_DMOP_12095_12523

ANX_TIME = 02-JUL-2004 17:52:17.8

ANX_LONGITUDE = +061.929909<deg> (ROE) 061.929909<deg> (ESOV)

▲ = Balloon Launch Site

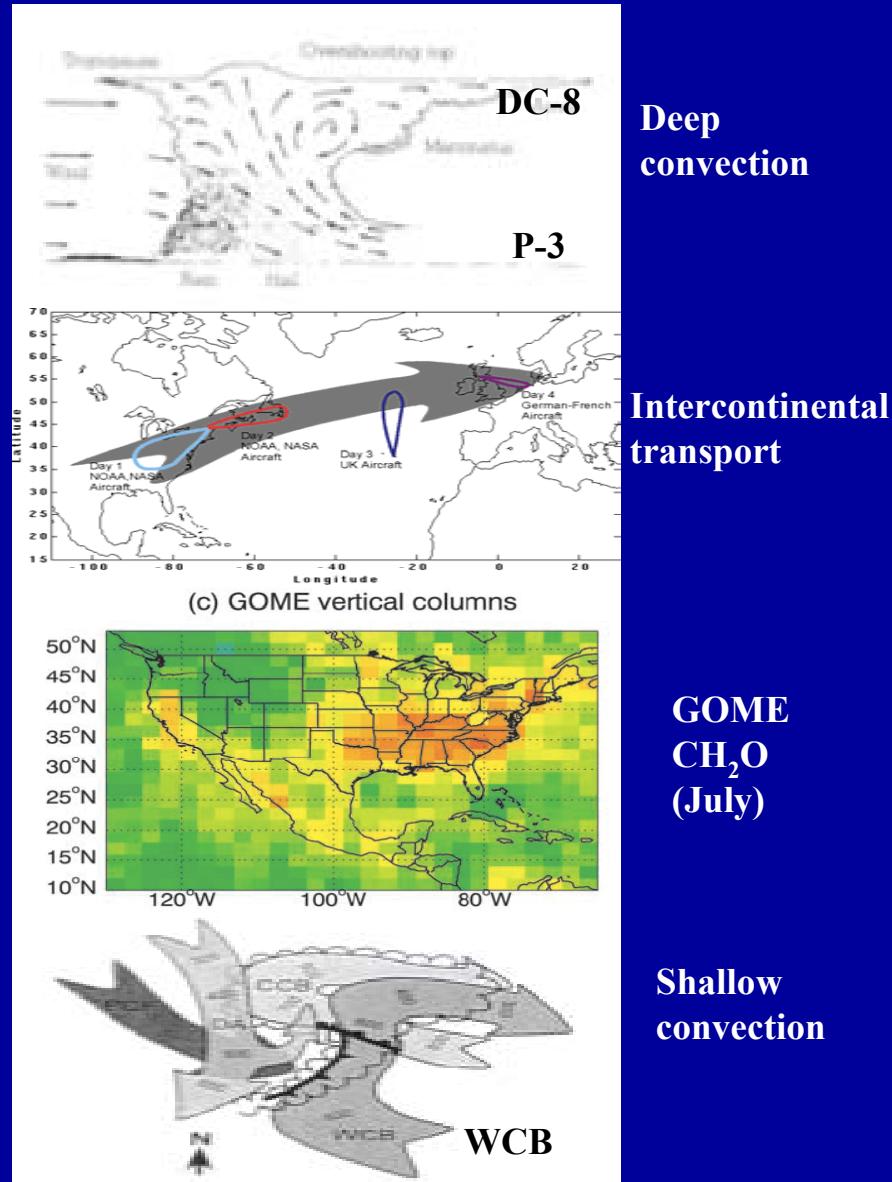
■ = Ground Measurement Site

NASA DC-8 coordinated flight possibilities

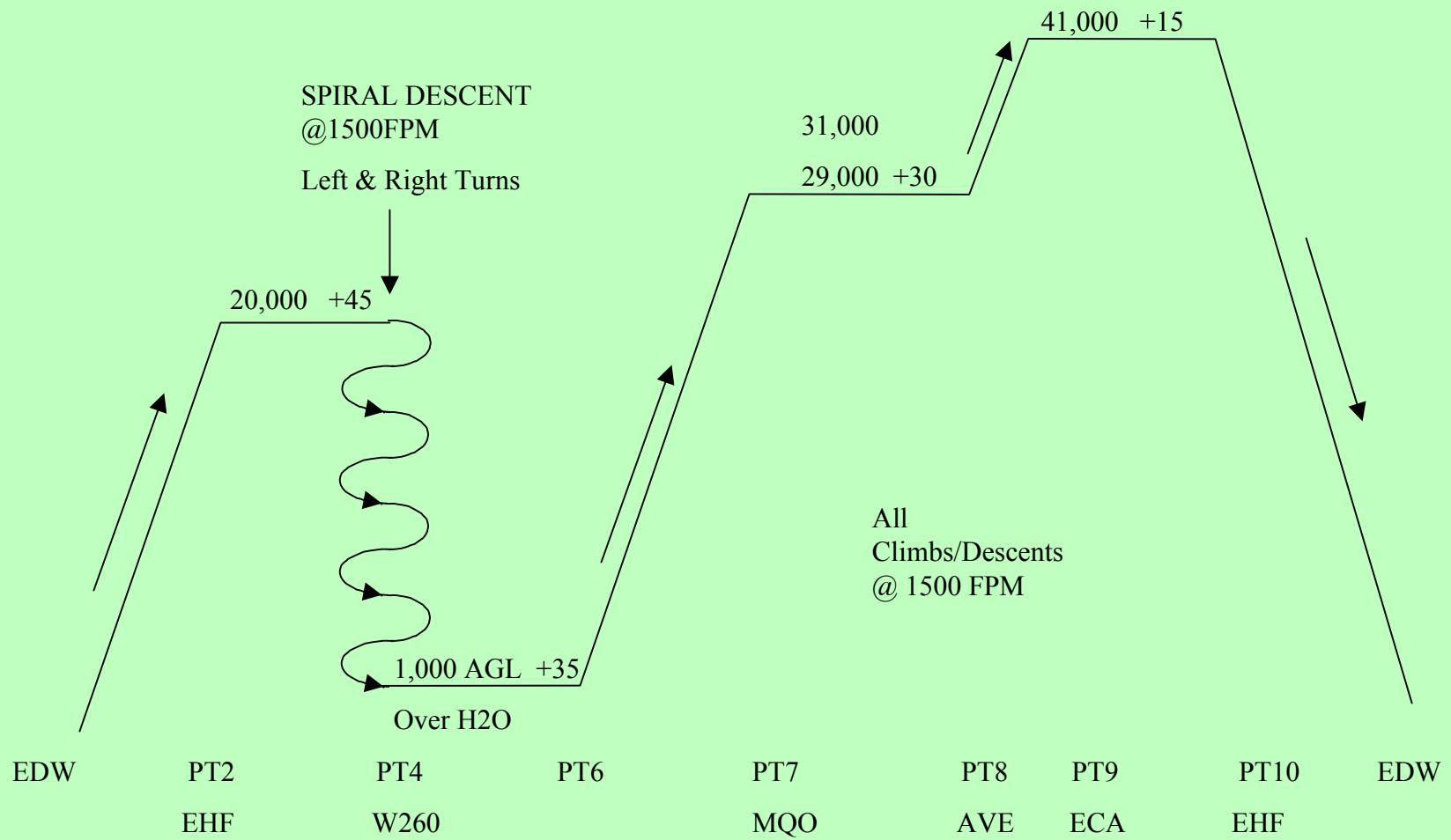
- NASA DC-8 and NOAA-P3 must coordinate activities when: (1) The phenomenon in question requires intensive high and low altitude sampling; (2) the spatial and/or temporal scales involved are too large for a single AC; (3) inter-comparisons and/or complimentary measurements are needed.

Examples of these are:

- Deep convection over the central/eastern US
- Quasi-Lagrangian experiments over the Atlantic
- Large scale pollution accumulation during high pressure stagnation over eastern US
- Investigation of the GOME formaldehyde bloom and its linkage with isoprene emissions
- Extended low level easterly outflow over the Atlantic and/or shallow WCB convection
- Photochemistry during Day-night transitions where DC-8 takes advantage of & extends P3 night time capability
- Inter-comparisons



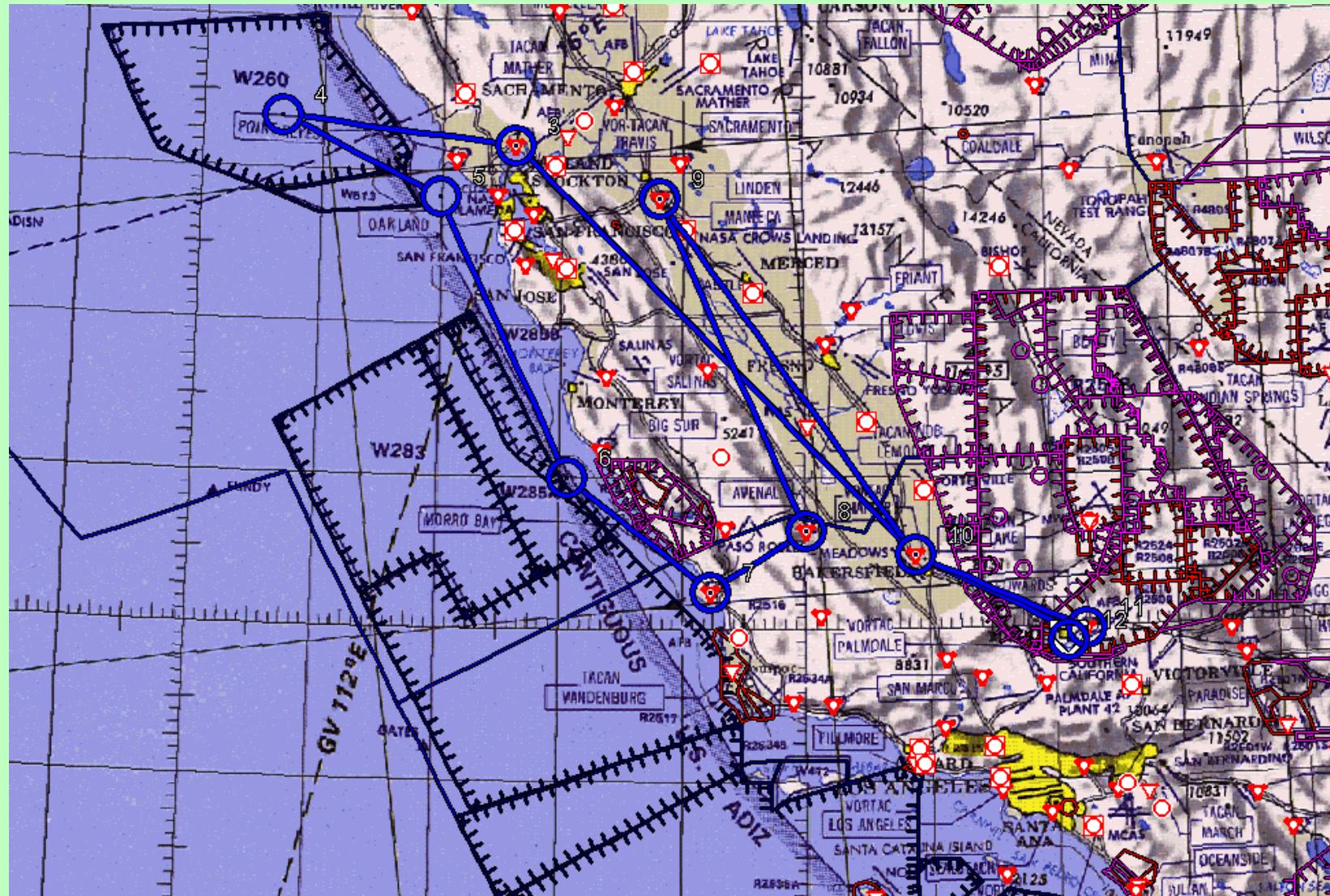
INTEX JUNE 26



DC-8 instrument payload



Parameters	Method*	PIs
O ₃	NO/O ₃ Chemiluminescence	M. Avery, NASA LaRC
NO, NO ₂ , HCHO	Laser Induced Fluorescence	D. Tan, GIT/EAS
CO, CH ₄ , N ₂ O	Tunable Diode Laser Absorption Spectrometry	G. Sachse, NASA LaRC
VOCs (NMHC, halocarbons, alkyl nitrates)	Whole air sample collection; GC-FID/EC/MS analysis	D. Blake, UC Irvine E. Atlas, U. Miami
NO ₂ , NO _y	Laser Induced Fluorescence & thermal dissociation	R. Cohen, UC Berkeley
CO ₂	Non-Dispersive Infrared (NDIR)	S. Vay, NASA LaRC
CH ₂ O	Tunable Diode Laser Absorption Spectrometry	A. Fried, NCAR
PANs, OVOC, nitriles, tracers	GC-ECD/PID/RGD	H. Singh- NASA ARC
H ₂ O	Open path Tunable Diode Laser Absorption Spectrometry	G. Diskin- NASA LaRC J. Podolske, NASA ARC
OH, HO ₂ , RO ₂	Laser Induced Fluorescence	W. Brune, Penn State Univ.
HNO ₃ , bulk aerosol composition	Mist chamber/GC-IC	R. Talbot, Univ. of New Hampshire
SO ₂ , HNO ₄	Chemical Ionization Mass Spectrometry	G. Huey GIT-EAS
HNO ₃ , H ₂ O ₂ , organic acids	Chemical Ionization Mass Spectrometry	P. Wennberg, Cal Tech
Aerosol bulk ionic composition	Particle Into Liquid Sampling (PILS)/IC	R. Weber GIT-EAS
H ₂ O ₂ , CH ₃ OOH, HCHO	HPLC-fluorometry	B. Heikes, Univ. of Rhode Island
Aerosol, O ₃ profile	UV Lidar	E. Browell, NASA LaRC
Actinic fluxes & photolytic frequencies	Spectrally resolved Radiometer, Zenith & Nadir	R. Shetter, NCAR
H ₂ O, J(NO ₂)	Cryogenic hygrometer, actinometer	J. Barrick, NASA LaRC
Aerosol composition, microphysics, and optical properties	Partical measuring probes, differential mobility analyzer, CN counters	A. Clarke, Univ. of Hawaii
Aerosol number density, size, and light scattering properties; cloud liquid water content	CN counters, cloud aerosol & precep. Spectrometer, soot photometer	B. Anderson, NASA GSFC



INTEX-NA/Phase A

**J. Gleason, Program Manager
NASA HQ**

INTEX Science Team

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D. Jacob, Deputy Mission Scientist for Flight Plan
J. Crawford, Deputy Mission Scientist for Data Management
W. Brune, Deputy Mission Scientist for Inter-com**

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D. Edwards, NCAR
H. Fuelberg, FSU (Mission meteorologists)
W. McMillan, UMBC
B. Pierce, LaRC
A. Thompson, GSFC/ARC

**Project manager
M. Craib
M. Gaunt
K. Shiff**

INTEGRATED Science Strategy

OBSERVATIONS

Satellite

Global coverage
Limited detail

Airborne

Detailed speciation/processes
Limited in time and space

Surface

High temporal resolution
Limited spatial resolution

Emissions, Meteorology
Chem/Phys processes

Global/regional
models

SCIENTIFIC OUTPUT
POLICY

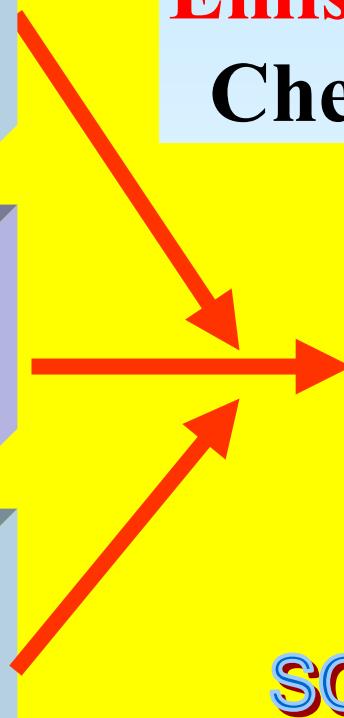


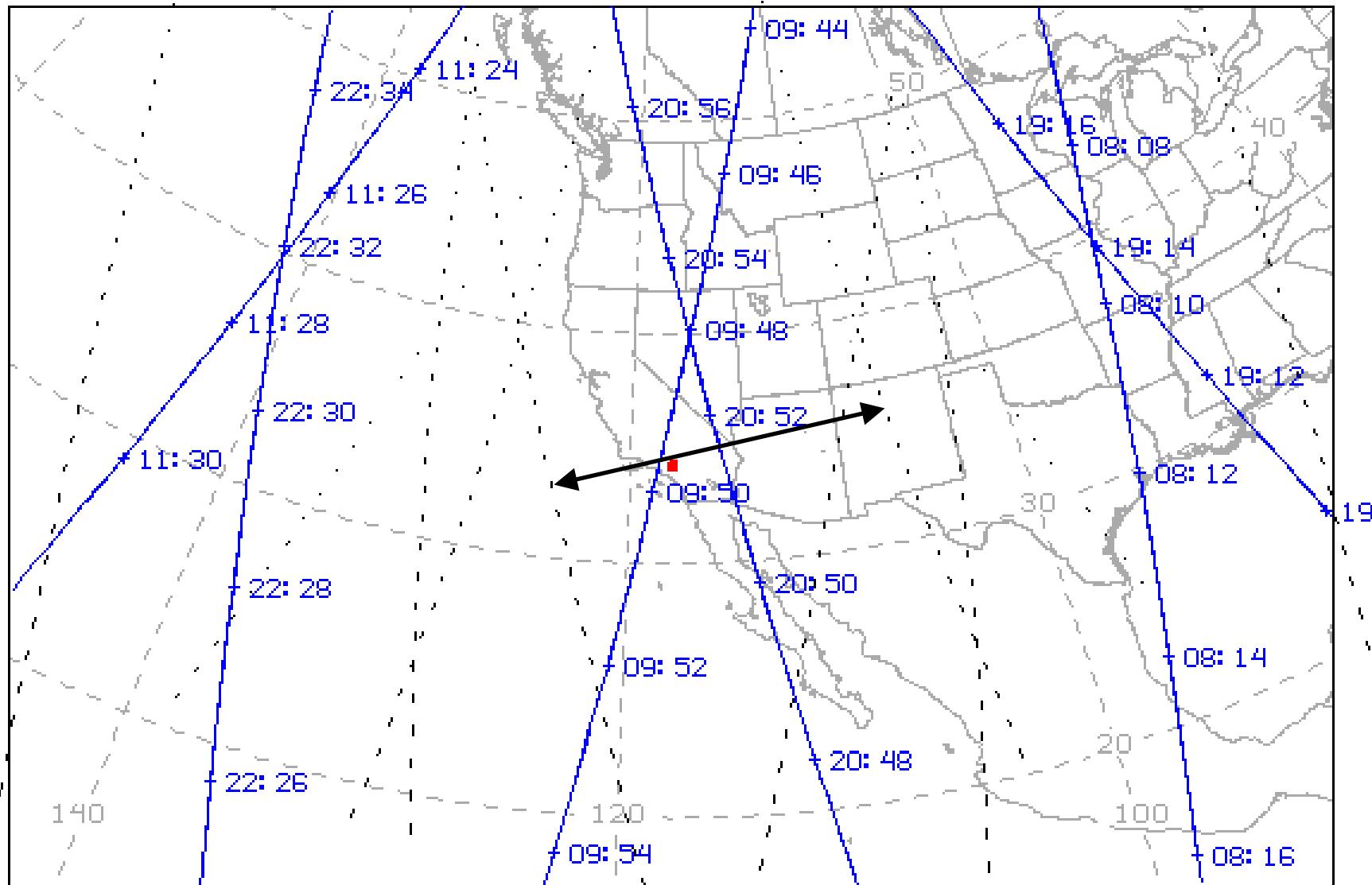
Table 1: INTEX-NA/Phase A sites, flight hours, and objectives

Type*	Dates (2004)	No of Flights	Flight Hours	Potential Objectives [#]	Comments
Test flight-DR		3	13		
Mission-DR	7/1	1	9	2,7,8	
Transit to M	7/6	1	9	2,6,7,8	
Missions-M	7/7-14	3	26	2,3,6,8	
Transit to PS	7/15	1	9	2,4,6,8	
Mission-PS	7/16- 8/10	9	78	1,2,4,5,8	1-2 suitcase flights
Transit to M	8/11	1	9	2,3,6,8	
Mission-M	8/13	1	9	2,3,6,8	
Transit to DR	8/14	1	8	2,7,8	
Total		21	170		

*DR-Dryden Flight Research Center, CA; M- mid-continental site
(St. Louis, MO or equivalent), PS-Pease AFB

1-Intercomparison, 2-Transcontinental characterization, 3-BL characterization and exchange with FT, 4-N. American outflow to Atlantic, 5-Aging of N. American outflow, 6-Convection influence, 7-Inflow from Pacific, 8-Satellite under-flight

Aqua Overpasses for 2 July (AIRS swath)



AQUA 2004/07/02

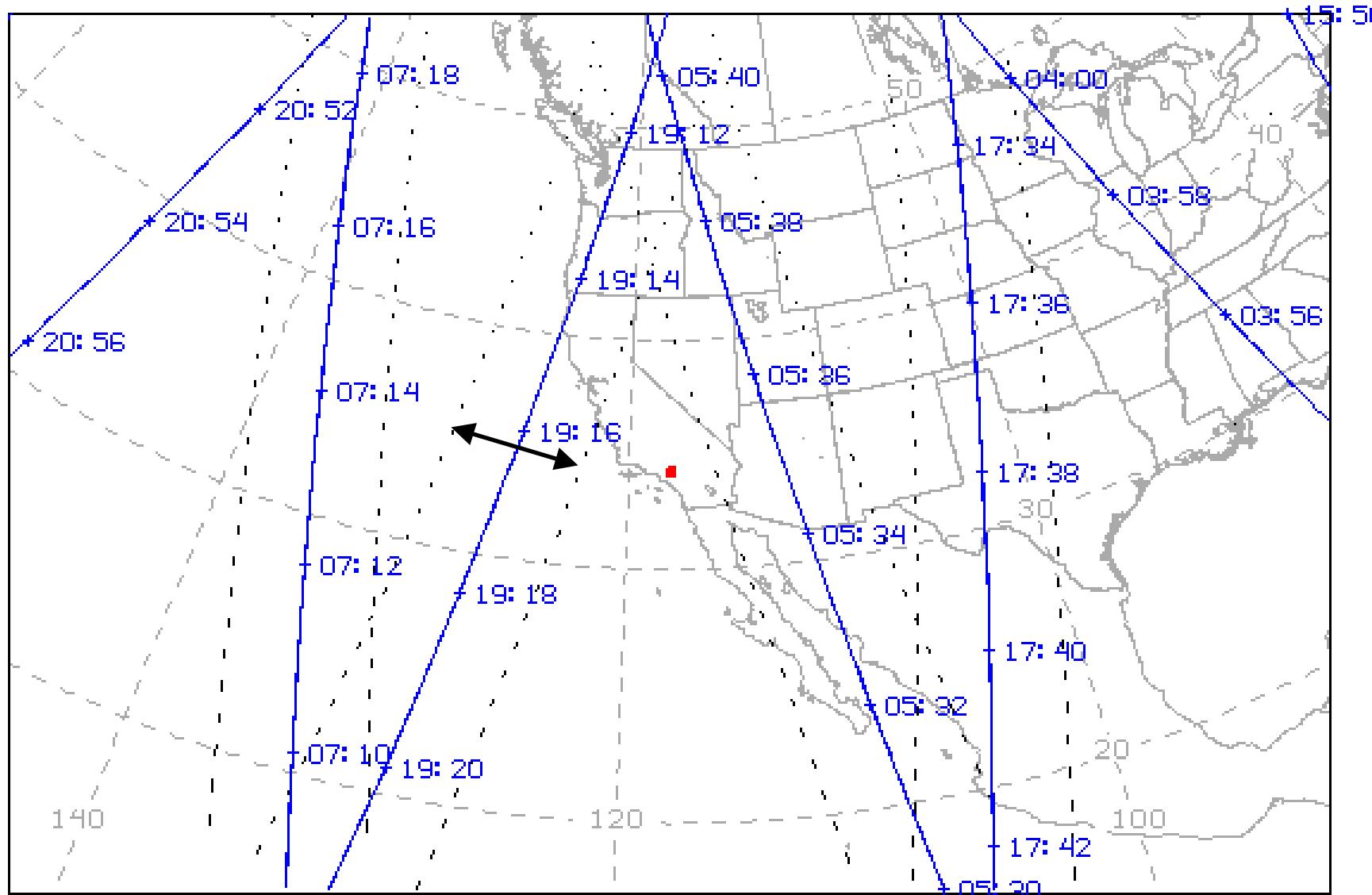
Lat: 34.93 Lon: 117.89

AQUA ORBITAL PREDICT PLOT

AIRS swath angle: 47.3 deg res: 20 km

EPOCH DATE: 04/06/17

Terra Overpasses for 2 July (MOPITT swath)



TERRA 2004/07/02

Lat: 34.93 Lon: 117.89

TERRA ORBITAL PREDICT PLOT

MOPITT swath angle: 24.2 deg res: 20 km

EPOCH DATE: 04/06/17